THE RAINBOW PLUS
SPECTRUM INTERFACE

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1.0 INTRODUCTION:

YOU ARE ABOUT TO INTRODUCE YOUR TIMEX COMPUTER INTO A NEW WORLD OF COMPUTING ! The RAINBOW plus interface will turn your computer into a SPECTRUM. With the RAINBOW plus attached your computer will be compatable with the most popular computer in Great Britan and Europe. The RAINBOW plus interface will allow you run to Spectrum programs numbering upwards to 5400! The advanced electronics in the RAINBOW plus allows it to run more software titles than many other emulators and more than just switching ROMs. The RAINBOW plus plugs into the expansion port of the computer - this eliminates possible damage to the computer by not having to open the case. It also allows you to use the cartridge dock when in the TIMEX 2068 mode. The mode switch allows changing operating systems with the interface attached.

In addition to running spectrum software, the RAINBOW plus also contains a Spectrum compatable expansion port. This allows your computer to run new and exciting Spectrum hardware like the DAMCO/ROTRONICS WAFADRIVE mass storage system, high resolution light pens, Spectrum joystick adapters, voice and speech synthesizers and more !

2.0 INSTALLATION

WITH THE COMPUTERS POWER TURNED O F F , attach the RAINBOW plus interface to the expansion port of the Timex 2068 computer. ALWAYS BE CERTAIN THAT THE KEY IS IN ITS PROPER POSITION IN THE INTERFACE'S CONNECTOR. IT IS IMPORTANT THAT THE INTERFACE BE INSTALLED PROPERLY TO PREVENT DAMAGE TO THE COMPUTER OR THE DIVICES BEING ATTACHED. To the left of the Spectrum expansion port in the rear of the interface is a small slide switch. This switch is used for selecting the operating system desired. Moving the switch to the left (as viewed from the front) to the position marked "T" will keep the computer in the Timex 2068 mode, moving the switch to the right to the position marked "S" will place the computer into the Spectrum mode. THE COMPUTER SHOULD ALWAYS BE TURNED OFF WHEN SWITCHING BETWEEN MODES ! NOTE - This switch is used only to change operating systems it does not change the expansion port from Spectrum to Timex. The Expansion port always remains Spectrum configured.

PRODUCTS DESIGNED EXCLUSIVELY FOR THE TIMEX 2068 COMPUTER SHOULD NOT BE ATTACHED TO THE EXPANSION PORT OF THE RAINBOW plus INTERFACE. However the 2040 printer and the 2050 modem can be used. It is safer to install products designed for the 2068 computer directly into the computer, and then install the RAINBOW plus interface into the pass through connector if so equipted.

3.0 USING THE SPECTRUM MODE

Upon turning on the computer in the Spectrum mode (switch position "S"), the display will go through two initializations. First the Timex copyright, followed by a momentary black screen, then the Sinclair copyright. Your computer is now operating in the Spectrum mode.

With the UDG area protected your RAINBOW plus offers 41472 bytes of free RAM - just like the 48K Spectrum. After CLEARing 65535 both the 2068 with interface attached, and the 48K Spectrum computer indicates 41640 bytes of RAM. Try this : CLEAR 65535 and/or PRINT 65535-USR 7962. Note: always try CLEAR 65535 before you decide a Spectrum program will not RUN.

The Timex 2068 computer requires a much stronger signal than does it's British counterpart. Many Spectrum tapes are recorded at lower volume level than Timex 2068 tapes. When loading a Spectrum program, your Volume setting on your recorder should be at a higher level. Another effectice way to boost the signal is by using the RADIO SHACK MINI AMPLIFIER (277-1008). This is also usefull in loading those stubborn Timex programs !

There are also some keyboard differences between the two computers. The following shows the functions not available on the Spectrum computer along with the function which does exist at the corresponding key location

KEYBOARD DIFFERENCES

KEY	TIMEX	SPECTRUM
P	RESET	©
A	FREE	~
S	STICK	|
F	ON ERR	{
G	SOUND	}

The Spectrum operating system is contained on EPROM within the RAINBOW plus interface. Placing this on EPROM allows some of the "known" bugs to be corrected. SCREEN$, 1/2-.5 and INT-65536 errors have been corrected. A special thanks to Robert Orrfelt of GESSO (3436 Bay Rd., Redwood City, Ca. 94063) for providing this information, as well as the EPROM programer. In addition to the above corrections, a USR graphics set has been added. To use enter USR then select the graphics function.

The following is an excerpt from the manual provided with the GESSO EPROM programer.

Section 3.

THEORY

There are three formats reconized by the TS2068 on initialization: LROS, BASIC AROS, and Machine Code AROS. BASIC AROS cartridges can also contain machine code, BASIC variables, etc.

LROS

An LROS replaces the operating system and takes over all functions of the computer. An example of an LROS is the SPECTRUM emulator. During the initialization process the cartridge is switched in and the second byte is read. If it is an 01 the fifth byte is used to switch in the proper chunks. A jump is then made to the address in the third and fourth bytes. From now on control is passed to the cartridge EPROM.

Making a SPECTRUM EPROM gives the opportunity to correct some of the errors in the original version. Example 1 on the next page shows my version with modifications.

Addresses 0001-0004 must be replaced with the LROS header. The starting address in the header is therefore to an unused SPECTRUM address (3870h). This address contains the original code starting at 0000 and ends with a jump to the normal initialization address for the SPECTRUM.

An alternate USR character set was added at 3CFFH.

```
20 20 20 20 20 00 00 00
00 00 60 60 60 00 00 00
18 3C 18 24 00 00 00 00
70 10 70 10 70 00 00 00
00 00 3C 42 42 24 66 00
50 50 50 70 10 00 00 00
70 40 70 10 70 00 00 00
70 40 70 50 70 00 00 00
00 00 18 24 38 24 3C 20
70 10 10 10 10 00 00 00
70 50 70 50 70 00 00 00
70 50 70 10 70 00 00 00
01 01 01 01 01 01 01 01
80 80 80 80 80 80 80 80
00 18 18 24 24 42 7E 00
00 00 00 7E 24 24 24 00
70 50 50 50 70 00 00 00
00 10 38 54 54 38 10 00
70 10 70 40 70 00 00 00
20 70 20 20 20 00 00 00
00 00 00 44 24 24 3C 40
```

Figure 3-1. Mod B USR Character Set.

Sinclair Spectrum EPROM Mod. B

The following are changes to the Spectrum code designated as Mod. B. The addresses and codes are given in hex. Thanks to Dr. Ian Logan Dr. Frank O'Hara for identifying the "bugs".

1. 0001 01 LROS
   0002 70
   0003 38 Starting address 3870
   0004 FC Chunks 1 and 2
   0005 42 Mod. # (B)

2. 006D 28 JR Z was JR NZ

3. 0A33 19 was 18 CHR$ 8 (backspace) error line 0 etc.

4. 1204 FF
   1205 3C address of new USR graphic characters (3CFF)

5. 1539 changed logo

```
1539 Sinclair Spectru
1549 m Mod. B
```

6. 257D C9 was C3 SCREEN$ error

7. 3200 DB was E1 1/2-.5 error

8. INT -65536 etc. error

```
3032 F5       PUSH AF
3033 3C       INC  A
3034 B3       OR   E
3035 B2       OR   D
3036 C22532   JP   NZ,3225H
3039 C33032   JP   3230H

3223 181A     JR   323FH
3225 F1       POP  AF
3226 77       LD   (HL),A
3227 23       INC  HL
3228 73       LD   (HL),E
3229 23       INC  HL
322A 72       LD   (HL),D
322B 2B       DEC  HL
322C 2B       DEC  HL
322D 2B       DEC  HL
322E D1       POP  DE
322F C9       RET
3230 F1       POP  AF
3231 2B       DEC  HL
3232 3691     LD   (HL),91H
3234 23       INC  HL
3235 3680     LD   (HL),80H
3237 3C       INC  A
3238 18ED     JR   3227H
```

9. Boot from address 0000

```
3870 F3       DI
3871 AF       XOR  A
3872 11FFFF   LD   DE,FFFFH
3875 C3CB11   JP   11CBH
```

Example 1. SPECTRUM EPROM

4.0 SPECTRUM EXPANSION PORT

The Expansion port of the RAINBOW plus has been configured to closely duplicate that of the Spectrum computer. When used with the Spectrum operating system, hardware designed for use with the Spectrum can be used with the Timex 2068. Because there are some major differences between the two computers, the following Spectrum signals are not used on the interface:

IORQGE — THIS SIGNAL APPEARS TO BE CONTROLLED INTERNALLY IN THE TIMEX 2068

VIDEO-
Y-----
Z-----
U----- — THESE SIGNALS ARE USED FOR EXTERNAL VIDEO (SUCH RGB AND MONITOR) ON THE SPECTRUM

-12v--
-5v--- — BASED ON THE IMFORMATION AVAILABLE THESE VOLTAGES ARE ARE NOT USED BY HARDWARE MANUFACTURERS

THE FOLLOWING IS A LIST OF THE SIGNALS USED ON BOTH THE TIMEX 2068 COMPUTER AND THE RAINBOW plus EXPANSION PORTS:

TS 2068 BUSS				ZX SPECTRUM BUSS			
TOP			BOTTOM	TOP			BOTTOM
GND	1	GND		A15	1	A14	
EAR	2	SPKR/TAPE OUT		A13	2	A12	
A7RQ	3	+15V		D7	3	+5V	
D7	4	+5V		not used	4	+9V	
DZIN	5	not used		slot	5	slot	
slot	6	slot		D0	6	GND	
D0	7	GND		D1	7	GND	
D1	8	GND		D2	8	0	
D2	9	0		D6	9	A0	
D6	10	A0		D5	10	A1	
D5	11	A1		D3	11	A2	
D3	12	A2		D4	12	A3	
D4	13	A3		INT	13	IORQGE	
INT	14	A15B		NMI	14	GND	
NMI	15	A14B		HALT	15	VIDEO	
HALT	16	A13B		MREQ	16	Y	
MREQB	17	A12		IORQ	17	Z	
IORQB	18	A11		RD	18	U	
RDB	19	A10		WR	19	BUSRQ	
WRB	20	A9		-5V	20	RESET	
BUSAK	21	A8		WAIT	21	A7	
WAIT	22	A7		+12V	22	A6	
BUSRQ	23	A6		-12V	23	A5	
RESET	24	A5		M1	24	A4	
M1	25	A4		RFSH	25	ROMCS	
RFSHB	26	not used		A8	26	BUSAK	
EXROM	27	RGB red		A10	27	A9	
ROSCS	28	RGB green		not used	28	A11	
BE	29	RGB blue					
IOA5	30	BUSISO					
SOUND	31	VIDEO					
GND	32	GND					